

Application No. 10/781,412
Amendment dated September 8, 2005
Reply to Final Office Action of August 8, 2005

Docket No. 1232-5294

Amendments to the Claims:

Claims 1-39 are pending in this application. This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1 (PREVIOUSLY PRESENTED): A retainer for holding an optical element, said retainer comprising:

a detector for detecting a deformation amount of the optical element; and
an adjustment unit for adjusting the deformation of the optical element by applying a force to the optical element in a direction opposing to a gravity direction based on the deformation amount.

2 (ORIGINAL): A retainer according to claim 1, wherein said detector is a strain gauge.

3 (ORIGINAL): A retainer according to claim 1, wherein said detector is arranged on the optical element.

4 (ORIGINAL): A retainer according to claim 1, wherein three detectors are arranged on the same circumference at a pitch of 120°.

5 (ORIGINAL): A retainer according to claim 1, wherein said adjustment unit equalizes a load applied to the optical element.

6 (ORIGINAL): A retainer according to claim 1, wherein said adjustment unit adjusts the load applied to the optical element to reduce aberration of the optical element.

7 (ORIGINAL): A retainer according to claim 5, wherein said adjustment unit includes a coil spring.

8 (ORIGINAL): A retainer according to claim 7, wherein said adjustment unit includes an adjustment screw for adjusting a length of the coil spring.

Application No. 10/781,412
Amendment dated September 8, 2005
Reply to Final Office Action of August 8, 2005

Docket No. 1.232-5294

9 (ORIGINAL): A retainer according to claim 1, wherein three adjustment units are arranged on the same circumference at a pitch of 120°.

10 (ORIGINAL): A retainer according to claim 1, further comprising a support part that supports the optical element at approximately three points.

11 (ORIGINAL): A retainer according to claim 1, wherein there are three detectors and three support parts, wherein each detector is arranged between two adjacent supports parts.

12 (ORIGINAL): A retainer according to claim 1, wherein there are three adjustment units and three support parts, wherein each detector is arranged between two adjacent supports parts.

13 (ORIGINAL): A retainer according to claim 1, wherein the number of adjustment units is more than the number of detectors, and said adjustment units are driven based on detection results by said detectors.

14 (PREVIOUSLY PRESENTED): A retainer according to claim 1, further comprising a support part that supports the optical element at approximately three points, wherein said adjustment unit is provided every space between adjacent two points among the three points, and said detector is located at at least one of the spaces among the three points.

15 (ORIGINAL): A retainer according to claim 1, wherein said detector and said adjustment unit are integrated with each other.

16 (ORIGINAL): A retainer according to claim 1, wherein the adjustment unit includes a component, and said detector detects the deformation amount by using the component in said adjustment unit.

17 (PREVIOUSLY PRESENTED): A retainer according to claim 1, wherein the adjustment unit includes a component, and said detector detects the deformation amount by measuring a strain amount of the component in said adjustment unit.

18 (PREVIOUSLY PRESENTED): A retainer for holding an optical element, said retainer

Application No. 10/781,412
Amendment dated September 8, 2005
Reply to Final Office Action of August 8, 2005

Docket No. 1232-5294

comprising:

an adjustment unit for adjusting a shape of the optical element, said adjustment unit including a component; and

a detector for detecting a deformation amount of the component in said adjustment unit, said adjustment unit adjusting the shape of the optical element by applying a force to the optical element in a direction opposing to a gravity direction based on a detection result by said detector.

19 (PREVIOUSLY PRESENTED): A retainer according to claim 18, further comprising a support part for supporting the optical element at approximately three points, and adjustment units are arranged at intervals of the approximately three points.

20 (PREVIOUSLY PRESENTED): An adjustment method for adjusting a shape of an optical element into a desired shape, said method comprising the steps of:

obtaining the shape of the optical element;

calculating a force to be applied to the optical element to correct the shape of the optical element into the desired shape; and

applying the force calculated by said calculating step to the optical element in a direction opposing to a gravity direction.

21 (ORIGINAL): An adjustment method according to claim 20, further comprising the steps of: detecting wave front aberration of the optical element; and applying the force to the optical element so that the wave front aberration falls within a permissible range.

22 (PREVIOUSLY PRESENTED): An exposure apparatus comprising:

a retainer for holding an optical element, said retainer including a detector for detecting a deformation amount in a shape of the optical element, and an adjustment unit for adjusting the shape of the optical element by applying a force to the optical element in a direction opposing to a gravity direction based on the deformation amount; and

an optical system for exposing a pattern formed on a mask or reticle onto an object through the optical element held by the retainer.

Application No. 10/781,412
Amendment dated September 8, 2005
Reply to Final Office Action of August 8, 2005

Docket No. 1232-5294

23 (PREVIOUSLY PRESENTED): An exposure apparatus comprising:

a retainer for holding an optical element, said retainer including an adjustment unit for adjusting a shape of the optical element, said adjustment unit including a component, and a detector for detecting a deformation amount of the component in said adjustment unit, the adjustment unit adjusting the shape of the optical element by applying a force to the optical element in a direction opposing to a gravity direction based on a detection result by said detector; and

an optical system for exposing a pattern formed on a mask or reticle onto an object through the optical element held by the retainer.

24 (ORIGINAL): A device fabrication method comprising the steps of:

exposing a pattern on a mask, onto an object by using an exposure apparatus that includes a retainer that includes three support parts for supporting an optical element, a first unit for applying a first elastic force to the optical element in an anti-gravity direction, and a second unit, arranged opposite to the first unit through the optical element, for applying a second elastic force to the optical element in a gravity direction, and an optical system for exposing a pattern formed on a mask or reticle onto an object through the optical element held by the retainer and developing the object that has been exposed.

25 (PREVIOUSLY PRESENTED): A device fabrication method comprising the steps of:

exposing a pattern on a mask, onto an object by using an exposure apparatus that includes a retainer for holding an optical element, said retainer including an adjustment unit for adjusting a shape of the optical element, said adjustment unit including a component, and a detector for detecting a deformation amount of the component in said adjustment unit, the adjustment unit adjusting the shape of the optical element by applying a force to the optical element in a direction opposing to a gravity direction based on a detection result by said detector, and an optical system for exposing a pattern formed on a mask or reticle onto an object through the optical element held by the retainer; and

developing the object that has been exposed.

Application No. 10/781,412
Amendment dated September 8, 2005
Reply to Final Office Action of August 8, 2005

Docket No. 1232-5294

26 (PREVIOUSLY PRESENTED): A retainer for holding an optical element, said retainer comprising:

a detector for detecting a deformation amount of the optical element; and
an adjustment unit for adjusting the deformation of the optical element based on
the deformation amount,
wherein said detector is a strain gauge.

27 (PREVIOUSLY PRESENTED): A retainer for holding an optical element, said retainer comprising:

a detector for detecting a deformation amount of the optical element; and
an adjustment unit for adjusting the deformation of the optical element based on
the deformation amount,
wherein three detectors are arranged on the same circumference at a pitch of 120°.

28 (PREVIOUSLY PRESENTED): A retainer for holding an optical element, said retainer comprising:

a detector for detecting a deformation amount of the optical element; and
an adjustment unit for adjusting the deformation of the optical element based on
the deformation amount,
wherein said adjustment unit equalizes a load applied to the optical element, and
includes a coil spring.

29 (PREVIOUSLY PRESENTED): A retainer for holding an optical element, said retainer comprising:

a detector for detecting a deformation amount of the optical element; and
an adjustment unit for adjusting the deformation of the optical element based on
the deformation amount,
wherein said adjustment unit equalizes a load applied to the optical element, and
includes a coil spring and an adjustment screw for adjusting a length of the coil spring.

Application No. 10/781,412
Amendment dated September 8, 2005
Reply to Final Office Action of August 8, 2005

Docket No. 232-5294

30 (PREVIOUSLY PRESENTED): A retainer for holding an optical element, said retainer comprising:

a detector for detecting a deformation amount of the optical element; and
an adjustment unit for adjusting the deformation of the optical element based on the deformation amount,
wherein three adjustment units are arranged on the same circumference at a pitch of 120°.

31 (PREVIOUSLY PRESENTED): A retainer for holding an optical element, said retainer comprising:

a detector for detecting a deformation amount of the optical element;
an adjustment unit for adjusting the deformation of the optical element based on the deformation amount; and
a support part that supports the optical element at approximately three points.

32 (PREVIOUSLY PRESENTED): A retainer for holding an optical element, said retainer comprising:

a detector for detecting a deformation amount of the optical element; and
an adjustment unit for adjusting the deformation of the optical element based on the deformation amount,
wherein there are three detectors and three support parts, wherein each detector is arranged between two adjacent support parts.

33 (PREVIOUSLY PRESENTED): A retainer for holding an optical element, said retainer comprising:

a detector for detecting a deformation amount of the optical element; and
an adjustment unit for adjusting the deformation of the optical element based on the deformation amount,

Application No. 10/781,412
Amendment dated September 8, 2005
Reply to Final Office Action of August 8, 2005

Docket No. 1232-5294

wherein there are three adjustment units and three support parts, wherein each detector is arranged between two adjacent supports parts.

34 (PREVIOUSLY PRESENTED): A retainer for holding an optical element, said retainer comprising:

a detector for detecting a deformation amount of the optical element;
an adjustment unit for adjusting the deformation of the optical element based on the deformation amount; and
a support part that supports the optical element at approximately three points, wherein said adjustment unit is provided every space between adjacent two points among the three points, and said detector is located at at least one of the spaces among the three points.

35 (PREVIOUSLY PRESENTED): A retainer for holding an optical element, said retainer comprising:

a detector for detecting a deformation amount of the optical element; and
an adjustment unit for adjusting the deformation of the optical element based on the deformation amount,
wherein said detector and said adjustment unit are integrated with each other.

36 (PREVIOUSLY PRESENTED): A retainer for holding an optical element, said retainer comprising:

a detector for detecting a deformation amount of the optical element; and
an adjustment unit for adjusting the deformation of the optical element based on the deformation amount,
wherein the adjustment unit includes a component, and said detector detects the deformation amount by measuring a strain amount of the component in said adjustment unit.

Application No. 10/781,412
Amendment dated September 8, 2005
Reply to Final Office Action of August 8, 2005

Docket No. 1232-5294

37 (CURRENTLY AMENDED): A retainer for holding an optical element, said retainer comprising:

an adjustment unit for adjusting a shape of the optical element, said adjustment unit including a component;

a detector for detecting a deformation amount of the component in said adjustment unit, said adjustment unit adjusting the shape of the optical element based on a detection result by said detector; and

a support ~~pan~~ part for supporting the optical element at approximately three points, wherein adjustment units are arranged at intervals of the approximately three points.

38 (CURRENTLY AMENDED): An adjustment method for adjusting a shape of the ~~an~~ optical element into a desired shape, said method comprising the steps of:

obtaining the shape of the optical element;

calculating a force to be applied to the optical element to ~~collect~~ correct the shape of the optical element into the desired shape;

applying the force calculated by said calculating step to the optical element;

detecting wave front aberration of the optical element; and

applying the force to the optical element so that the wave front aberration falls within a permissible range.

39 (CANCELLED):